# Novel Method for Achieving Self-Sustaining Temperatures of Well-Below the 200nK Level Suitable for Quantum Computing and Other Applications

11 July 2023
Simon Edwards
Research Acceleration Initiative

## Introduction

In order to understand how to move beyond the need for LASER lattices for maintaining ultra-cold temperatures, one needs to understand the source of the resistance met at the ~200nK level to further cooling. If one wishes to take advantage of these temperatures for computing applications, one would need to be able to eventually deactivate the LASER cooling mechanism traditionally used for such cooling as the introduction of light into a quantum system would be, ostensibly, corruptive to any data stored in such a system. In so understanding the source of resistance to cooling beyond this level, one may devise a method for coaxing systems of atoms into spontaneously cooling to temperatures even lower than 200nK without the need for LASER cooling beyond the initial cooling phase(s.)

## Abstract

The source of nanokelvin-scale heating in ultra-cold systems, currently attributed by the scientific community to the "quantum foam," is, in reality, attributable to the chance alignment of atoms of like-charge with respect to one another. Although nuclear oscillation may be virtually non-existent in ultra-cold atoms, the drift of whole atoms (electrons included) in terms of overall position creates chance alignments of atoms and, consequently, ultra-weak Coulomb Force Lines that can generate thermal motion.

With this understanding, it is possible to go about preventing these alignments. Rather than preventing these alignments caused by the natural and random drift of atoms and molecules by introducing additional Coulomb Force Lines (which would only introduce further heat into the system,) a better approach would be to create a system that self-sustains an ultra-cold temperature without the need for outside intervention.

To achieve this goal, one would begin by using traditional methods of cooling to achieve extremely low temperatures (first liquid nitrogen, then LASER cooling,) at which point, a tertiary step in the process is implemented that bestows upon a system of atoms the quality of self-sustaining their ultra-cold temperature. This tertiary step is the addition or removal of electrons from a body of atoms so as to bring about a condition in which there is a precise 1:1 ratio of weakly (+/- one electron) anionized and cationized atoms. In order to perform this task, LASER cooling must be disengaged as LASERs are intrinsically cationizing.

As temperatures would quickly rebound with the disengaging of LASER cooling, the novel method referred herein as the "tertiary step" would need to be implemented with extreme speed and precision in synchrony with the disengagement of the LASER. Incidentally, this step would introduce a modest amount of heat to the system, but not so much as to undermine the end for which it is designed.

Provided that the ionization state sc. the number of extra electrons in each atom of the system can be known and that the position of the atoms in the system is known, it should be possible to target the electron clouds of each atom within the system with their own dedicated beam of accelerated protons in which each proton may be expected to carry away a single electron. If, for instance, we know that each atom in the system is in a (+3) cationized state, then we know that we need to remove two electrons from exactly one half of the atoms and four electrons from the other so that the body may be made to consist of precisely 50% (+1) and 50% (-1) charged atoms.

Ordinarily, a body of atoms with this sort of imbalanced charge would return spontaneously to a neutral state as electrons would be free to flow. At nanokelvin-scale temperatures, however, if radical protons are used to selectively remove electrons (being careful never to allow these protons to strike nuclei as this would generate massive thermal heating,) the imbalance of electrical charge would be sustained.

Given that this may be achieved, the atoms in the ultra-cold body would have a tendency to assume an alternating pattern in which few alignments would exist and any alignments that did come about would be self-negating in terms of net Coulomb Force. In the absence of any possibility of multiple like-charge particles coming into alignment, there would be no source of quantum heating and temperatures would continue to fall, eventually achieving a stable minimum. Critical to achieving this goal would be the ability to direct hundreds of discrete proton beams at hundreds of targets in which those targets are electron clouds and in which no nucleus may accidentally be struck by one of these protons.

## Conclusion

For quantum systems that require both absolute zero and quantum isolation, this approach would provide an ideal solution as once such a system is ionically calibrated and thermally isolated, its thermal properties would be indefinitely self-sustaining provided that the thermal isolation mechanism is not compromised. While more conventional chilling methods would continue to be required in the manufacture of what might be termed "Perma-Zero Modules" (PZMs,) those sorts of energy-intensive processes would not be needed; using this novel approach; to maintain those low temperatures, opening up new possibilities for the field and resolving a longstanding conundrum.